

# PATENT SPECIFICATION (11)

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## (54) IMPROVEMENTS IN OR RELATING TO PISTONS FOR MACHINES SUCH AS COMPRESSORS

(71) We, ROBERT BOSCH GmbH, a German company of Postfach 50, 7 Stuttgart 1, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns pistons for machines such as compressors.

Such pistons are often of stepped configuration and have a fluid flow passage for lubricating oil or cooling fluid formed in a hollow gudgeon pin received in a transverse bore of the piston, the gudgeon pin having a transverse bore communicating with its interior. One such piston is described in German patent specification No. 1,145,741.

In pistons of this type, the lubrication of the upper piston ring region gives rise to special difficulties, because that region is spaced so far from the oil supply in the crankcase housing. For this reason, the connecting rod which drives the piston is provided with an oil drilling which runs from the one boss of the connecting rod to the other, and a piston gudgeon pin journalled in the smaller connecting rod boss is provided with a radial bore, which connects with the oil drilling and guides the oil into the hollow gudgeon pin interior. From there, the oil is taken by way of a further radial bore to the piston and then to the lubricating position. In order that the radial bores may receive and further conduct the oil, annular grooves are necessary in the connecting rod bearing and in the piston. Moreover, the piston gudgeon pin must be axially fixed, preferably by means of two snap rings. Oil conduction of this nature is difficult and expensive.

Moreover, compressors and in general in machine pistons suffer not only the problem of lubrication but also that of cooling by conducting away heat, and it is difficult to provide a simple and inexpensive oil- and cooling-medium flow path through the pistons.

The present invention accordingly provides a machine piston which has a lubricating-

and/or cooling-oil flow passage through a hollow piston gudgeon pin, which is inserted in an uninterrupted transverse bore of the piston and which has two diametrically opposed holes in its wall communicating with its oil conducting hollow interior, in which a pin is inserted in one of those holes of the piston gudgeon pin, which hole is not required for oil flow, and which pin is the sole element securing the piston gudgeon pin axially and against rotation in the piston.

Compared with those hitherto available, the piston provided by the invention has the advantage that oil or cooling medium flow paths therein do not render necessary any expensive and difficult artifices. Retainer rings and their associated grooves for axially securing the piston gudgeon pin as well as the annular grooves for oil- or cooling-medium conduction from the piston gudgeon pin to the piston can be dispensed with.

The piston may conveniently be a stepped piston of a multi-stage compressor.

The invention will be described further, by way of example, with reference to the accompanying drawing, which is an axial section through a piston and gudgeon pin assembly embodying the invention.

A piston 1 of a piston machine is of stepped configuration and is intended for use in a multi-stage compressor (not shown). The piston 1 has an upper, larger diameter piston ring region 2 and a lower, smaller diameter region 3. During lubrication, the lower piston ring region 3 gives rise to no difficulties, since lubrication can take place directly from the usual crankcase housing, but lubrication of the upper piston ring region is somewhat more difficult. There is therefore provided a connecting rod 4 with an oil passage 5 running between its two bosses, of which the boss 4<sup>1</sup> is shown in the drawing, and the boss 4<sup>1</sup> has an annular groove 6 which leads the oils to a piston gudgeon pin 7, which is movably journalled in the boss 4<sup>1</sup>.

The gudgeon pin 7, in the region of the annular groove 6, has a radial bore 7<sup>1</sup> by way of which the oil passes to the hollow interior 8 of the pin 7. The hollow interior 8 is produced

in a simple manner as a blind bore and its opening is sealed tightly relative to the exterior by means of a press fitted cap 9. Closure of the interior 8 may alternatively be effected with a plug, bolt or screw.

The piston gudgeon pin 7 is journalled in a transverse bore 10 of the piston 1 and is sealed with two O-rings 11 and 12. A radial bore 13 formed by two diametrically opposed holes is provided near the inner end of the blind bore, through one of which holes (the upper as viewed in the Figure) the oil passes out again from the gudgeon pin 7 into a passage 14, which runs axially parallel in the material of the piston 1 and, by way of a radial passage 15, leads to the upper piston ring region 2. In this way, a path is created for the oil from the crankcase housing to the upper ring region 2, serving to maintain the latter well protected with lubricating oil. Cooling medium can be conducted in the same way at least in the region of the piston gudgeon pin 7, by which heat from the upper part of the stepped piston can be conducted away.

In order to hold the piston gudgeon pin 7 securely against axial and rotational displacement in the transverse bore 10, a screw 16 having a pin 17 is arranged axially parallel to the piston axis in the piston 1. The pin 17 is inserted in the second of the two holes forming the radial bore 13, which hole (the lower as viewed) is not required for the conduction of lubricating or cooling oil. The pin 17 thereby serves simultaneously both to secure the piston gudgeon pin 7 against rotation and makes it unnecessary to cut an internal annular groove in the transverse bore 10 for snap rings to prevent axial movement. The upper hole of radial bore 13 and passage 14 always align themselves with one another.

In this way, not only is the piston gudgeon pin 7 axially fixed and secured against rotation but, it is also possible to produce the holes forming radial bore 13 as a simple diametrical through bore. The one wall of the pin 7, shown in the drawing as the upper wall 18, is provided with a drilling constituting a lubricating or cooling-oil flow passage and

the other, lower wall 19, has a drilling which serves as a plug hole for the pin 17. The latter drilling is thus the locating hole for determining the attitude of the piston gudgeon pin 7 relative to the passage 14. The pin 17 is preferably fitted in a fluid tight manner into the wall 19 and is thus a closure for the locating hole.

#### WHAT WE CLAIM IS:—

1. A machine piston which has a lubricating- and/or cooling-oil flow passage through a hollow piston gudgeon pin, which is inserted in an uninterrupted transverse bore of the piston and which has two diametrically opposed holes in its wall communicating with its oil-conducting hollow interior, in which a pin is inserted in one of those holes of the piston gudgeon pin, which hole is not required for oil flow, and which pin is the sole element securing piston gudgeon pin axially and against rotation in the piston.

2. A piston as claimed in claim 1, in which the securing pin is an extension of a screw engaged in the piston axially parallel to the same.

3. A piston as claimed in claim 1 or claim 2, in which the opposed holes form a diametral through bore and act in one wall portion of the piston gudgeon pin as a flow passage for lubricating or cooling oil and in an opposed wall portion as a plug and locating hole for the securing pin.

4. A piston as claimed in claim 3, in which the securing pin is inserted in a fluid tight manner into said opposed wall portion of the piston gudgeon pin.

5. A piston as claimed in any one of claims 1 to 4 which is a stepped piston of a multi-stage compressor.

6. A machine piston constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

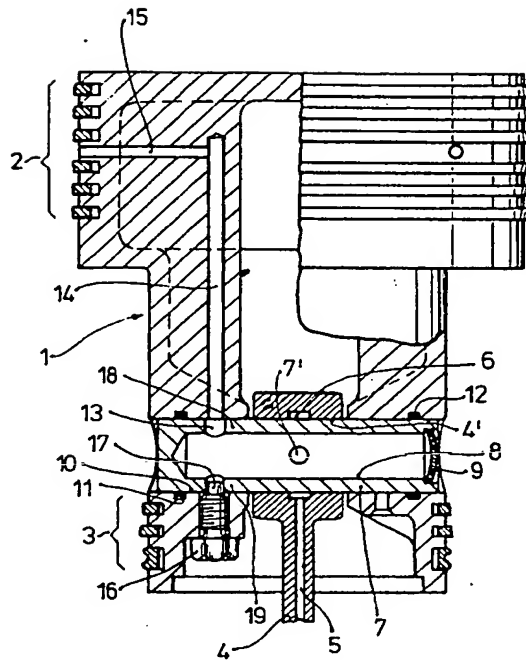
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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*



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